

# PATENT SPECIFICATION

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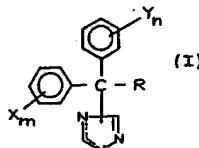
## (54) FUNGICIDAL AND NEMATICIDAL AGENTS

(71) We, BAYER AKTIENGESELLSCHAFT, a body corporate, organised under the laws of Germany, of Leverkusen, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:-

5 The present invention relates to the use, as fungicides and nematicides, of diphenyltriazolyl-methanes, some of which are known.

It has already been disclosed that certain trityl-1,2,4-triazoles, such as triphenyl-(1,2,4-triazol-1-yl)-methane, possess a good fungicidal activity (see German Offenlegungsschrift (German Published Specification) 1,795,249). Their action is, however, not always entirely 10 satisfactory, especially if low amounts and low concentrations are used.

It has been found that the diphenyl -triazolyl- methanes of the general formula



20 in which

R represents alkyl, alkylcarbonyl or optionally substituted phenylcarbonyl,  
 X and Y, which may be identical or different, each represent halogen, alkyl, halogenoalkyl, alkoxy, alkylthio, optionally substituted phenyl or phenoxy, nitro or cyano and  
 m and n each represent O or an integer from 1 to 5, and their physiologically tolerated salts exhibit powerful fungicidal and nematicidal properties.

The present invention therefore provides a nematicidal or fungicidal composition containing as active ingredient a compound of the formula (I), or a physiologically tolerated salt thereof, in admixture with a solid or liquefied gaseous diluent or carrier or in admixture with a liquid diluent or carrier containing a surface-active agent.

25 30 The present invention also provides a method of combating nematodes or fungi which comprises applying to the nematodes or fungi, or to a habitat thereof, a compound of the formula (I), or a physiologically tolerated salt thereof, alone or in the form of a composition containing as active ingredient such a compound or salt in admixture with a diluent or carrier.

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It is to be understood that the use of a mixture of two or more bases (I), of two or more salts or of at least one base (I) and at least one salt is comprehended herein.

The diphenyl-triazolyl-methanes of the general formula (I) are derivatives of 1,2,4-triazole in which the azole radical may be linked in the 1-position or in the 4-position.

5 Preferably, R represents alkyl with 1 to 4 carbon atoms, alkylcarbonyl with 1 to 4 carbon atoms in the alkyl part or phenylcarbonyl which is optionally substituted by halogen (especially fluorine, chlorine or bromine) or by alkyl with 1 or 2 carbon atoms, X and Y, which may be identical or different, each represent halogen (especially fluorine, chlorine or bromine), straight-chain or branched alkyl with 1 to 4 carbon atoms, halogenoalkyl with 1 to 4 carbon atoms and up to 5 halogen atoms (especially with 1 or 2 carbon atoms and up to 3 identical or different halogen atoms, the preferred halogens being fluorine and chlorine and the trifluoreomethyl group being mentioned as an example), cyano, nitro, alkoxy with 1 or 2 carbon atoms, alkylthio with 1 or 2 carbon atoms or phenyl or phenoxy, either of which is optionally substituted by halogen (especially fluorine, chlorine or bromine) or by alkyl with 1 or 2 carbon atoms, and m and n represent O, 1, 2 or 3 (especially O, 1 or 2).

Surprisingly, the active compounds which can be used according to the invention exhibit a substantially greater fungicidal action than the trityl-1,2,4-triazoles known from the state of the art, such as, for example, triphenyl-(1,2,4-triazol-1-yl)-methane. Their additional nematicidal action is equally surprising. Accordingly, the compounds which can be used according to the invention represent an enrichment of the art.

The following may be mentioned as individual examples of the active compounds which can be used according to the invention: 1,1-diphenyl-1-(1,2,4-triazol-1-yl)-ethane, 1,1-diphenyl-1-(1,2,4-triazol-1-yl)-ethane, 1-(4-chlorophenyl)-1-phenyl-(1,2,4-triazol-1-yl)-ethane, 1-(4-chlorophenyl)-1-phenyl-1-(1,2,4-triazol-4-yl)-ethane, 2-(2,4-dichlorophenyl)-1-phenyl-1-(1,2,4-triazol-1-yl)-ethane, 1-(4-fluorophenyl)-1-phenyl-1-(1,2,4-triazol-1-yl)-ethane, 1-(2-methylphenyl)-1-phenyl-1-(1,2,4-triazol-1-yl)-ethane, 1-(3-trifluoromethyl phenyl)-1-phenyl-1-(1,2,4-triazol-1-yl)-ethane, 1-(4-methoxyphenyl)-1-phenyl-1-(1,2,4-triazol-1-yl)-ethane, 1-(4-methylthio phenyl)-1-phenyl-1-(1,2,4-triazol-1-yl)-ethane, 1-(4-biphenyl)-1-phenyl-1-(1,2,4-triazol-1-yl)-ethane, 1-(4-4'-chlorobiphenyl-yl)-1-phenyl-1-(1,2,4-triazol-1-yl)-ethane, 1-(4-phenoxy-phenyl)-1-phenyl-1-(1,2,4-triazol-1-yl)-ethane, 1,1-diphenyl-1-(1,2,4-triazol-1-yl)-propane, 1,1-diphenyl-1-(1,2,4-triazol-4-yl)-propane, 1-(4-chlorophenyl)-1-phenyl-1-(1,2,4-triazol-4-yl)-propane, 1-(4-fluorophenyl)-1-phenyl-1-(1,2,4-triazol-1-yl)-propane, 1-(3,4-dimethyl phenyl)-1-phenyl-1-(1,2,4-triazol-1-yl)-propane, 1-(2,5-dimethylphenyl)-1-phenyl-1-(1,2,4-triazol-1-yl)-propane, 1,1-diphenyl-1-(1,2,4-triazol-1-yl)-butane, 1,1-diphenyl-1-(1,2,4-triazol-4-yl)-butane, 1-(4-chlorophenyl)-1-phenyl-1-(1,2,4-triazol-1-yl)-butane, 1-(r-chlorophenyl)-1-phenyl-1-(1,2,4-triazol-4-yl)-butane, 1-(4-fluorophenyl)-1-phenyl-1-(1,2,4-triazol-1-yl)-butane, 1-(3-methylphenyl)-1-phenyl-1-(1,2,4-triazol-1-yl)-butane, 1,1-diphenyl-2-methyl-1-(1,2,4-triazol-1-yl)-butane, 1-(4-chlorophenyl)-1-phenyl-2-methyl-1-(1,2,4-triazol-1-yl)-butane, 1-(2-methylphenyl)-1-phenyl-2-methyl-1-(1,2,4-triazol-1-yl)-butane, 1-(2,4-dimethyl phenyl)-1-phenyl-2-methyl-1-(1,2,4-triazol-1-yl)-butane, 1,1-di-phenyl-2,2-dimethyl-1-(1,2,4-triazol-1-yl)-propane, 1,1-diphenyl-2,2-dimethyl-1-(1,2,4-triazol-4-yl)-propane, 1-(2-chlorophenyl)-1-phenyl-2,2-dimethyl-1-(1,2,4-triazol-1-yl)-propane, 1-(4-chlorophenyl)-1-phenyl-2,2-dimethyl-1-(1,2,4-triazol-4-yl)-propane, 1-(4-chlorophenyl)-1-phenyl-2,2-dimethyl-1-(1,2,4-triazol-1-yl)-propane, 1-(4-fluorophenyl)-1-phenyl-2,2-dimethyl-1-(1,2,4-triazol-1-yl)-propane, 1-(3-trifluoromethyl phenyl)-1-phenyl-2,2-dimethyl-1-(1,2,4-triazol-1-yl)-propane, 1-(2-methyl phenyl)-1-phenyl-2,2-dimethyl-1-(1,2,4-triazol-1-yl)-propane, 1-(3-methylphenyl)-1-phenyl-2,2-dimethyl-1-(1,2,4-triazol-1-yl)-propane, 1-(4-methoxyphenyl)-1-phenyl-2,2-dimethyl-1-(1,2,4-triazol-1-yl)-propane, 1-(4-ethoxyphenyl)-1-phenyl-2,2-dimethyl-1-(1,2,4-triazol-1-yl)-propane, 1-(4-methylthio phenyl)-1-phenyl-2,2-dimethyl-1-(1,2,4-triazol-1-yl)-propane, 1-(4-chloro-3-methyl phenyl)-1-phenyl-2,2-dimethyl-1-(1,2,4-triazol-1-yl)-propane, 1-(3,4-dimethyl phenyl)-1-phenyl-2,2-dimethyl-1-(1,2,4-triazol-1-yl)-propane, 1-(2,4-dimethyl phenyl)-1-phenyl-2,2-dimethyl-1-(1,2,4-triazol-1-yl)-propane,

65 1-(2,4-dimethyl phenyl)-1-phenyl-2,2-dimethyl-1-(1,2,4-triazol-1-yl)-propane,

1-(4-phenoxy phenyl) -1- phenyl -2, 2-dimethyl- 1-(1,2,4 -triazol -1-yl) -propane, 1- (4-4' chlorophenoxy -phenyl) -1- phenyl -2, 2-dimethyl -1- (1,2,4 -triazol -1-yl) -propane, 1- (4-biphenyl) -1- phenyl -2, 2-dimethyl -1- (1,2,4 -triazol -1-yl) -propane, 1- (4-biphenyl) -1- phenyl-2, 2- dimethyl -1- (1,2,4 -triazol -4-yl) -propane, 1- (4-4' chlorobi- phenylyl) -1- phenyl -2, 2-dimethyl -1- (1,2,4 -triazol -1-yl) -propane, 1- (2, 4-dichlor phenyl) -1- phenyl -2, 2-dimethyl -1- (1,2,4 -triazol -1-yl) -propane, 1- (4-nitrophenyl) -1- phenyl-2, 2-dimethyl -1- (1,2,4 -triazol -1-yl) -propane, 1-(4- cyano-phenyl) -1- phenyl-2, 2-dimethyl -1- (1,2,4 -triazol -1-yl) -propane, 1-bis- (4-chlorophenyl) -2, 2-dimethyl -1- (1,2,4 -triazol -1-yl) -propane, 1-bis- (4-chlorophenyl) 5 5  
 10 2, 2-dimethyl- 1- (1,2,4- triazol -4-yl) -propane, 1-bis- (4-methyl phenyl) -2, 2-dimethyl 1- (1,2,4 -triazol -1-yl) -propane, 1-(4-chlorophenyl) -1- (4-fluoro phenyl) -2, 2-dimethyl 1- (1,2, 4-triazol -1-yl) -propane, 1-(4-fluoro phenyl) -1- (4-phenoxyphenyl) -2, 2-dimethyl -1- (1,2,4 -triazol -1-yl) -propane, 1-(4-biphenyl) -1- (4-phenoxy phenyl) -2, 2-dimethyl -1- (1,2,4 -triazol -1-yl) -propane, 1, 1-diphenyl -1- (1,2,4 -triazol -1-yl) 10 10  
 15 propan -2-one, 1, 1-diphenyl -1- (1,2,4 -triazol -4-yl) -propan -2-one, 1-(4- chlorophenyl) 1- phenyl -1- (1,2,4 -triazol -1-yl) -propan -2-one, 1-(4-chloro phenyl) -1- phenyl -1- (1,2,4 -triazol -4-yl) -propan -2-one, 1-(2, 4-dichloro phenyl) -1- phenyl -1- (1,2, 4-triazol 1- yl) -propan -2-one, 1-(4-fluoro phenyl) -1- phenyl -1- (1,2,4 -triazol -1-yl) -propan 20 20  
 20 2-one, 1-(2-methyl phenyl) -1- phenyl -1- (1,2,4 -triazol -1-yl) -propan -2-one, 1- (3-trifluoro methyl- phenyl) -1- phenyl -1- (1,2, 4-triazol -1-yl) -propan -2-one, 1- (4-methoxy phenyl) -1- phenyl -1- (1,2,4 -triazol -1-yl) -propan -2-one, 1-(4-biphenyl) -1-phenyl -1- (1,2,4 -triazol -1-yl) -propan -2- one, 1-(4-4' -chlorobi phenylyl) -1- phenyl -1- (1,2, 4-triazol -1-yl) -propan -2- one, 1- (4-phenoxy phenyl) -1- phenyl -1- (1,2,4 -triazol -1-yl) -propan -2- one, 1, 1-diphenyl -1- (1,2,4 -triazol -1-yl) -butan -2- one, 1, 1-diphenyl-1- (1,2,4- triazol -4- yl) 25 25  
 25 butan -2- one, 1- (4-chloro phenyl) -1- phenyl -1- (1,2,4 -triazol -1-yl) -butan -2- one, 1- (4-chlorophenyl) -1-phenyl -1- (1,2,4 -triazol -4- yl) -butan -2- one, 1- (4-fluoro phenyl) 1- phenyl -1- (1,2,4 -triazol -1-yl) -butan -2- one, 1-(3-methyl-phenyl) -1- phenyl -1- (1,2,4- triazol 1- yl) -butan -2- one, 1- (2,5- dimethyl phenyl) -1- phenyl -1- (1,2,4 -triazol -1-yl) -butan 30 30  
 30 2-one, 1, 1-diphenyl -1- (1,2, 4-triazol -1-yl) -pentan -2-one, 1, 1-diphenyl -1- (1,2,4 -triazol -4- yl) -butan -2- one, 1- (4-chloro phenyl) -1- phenyl -1- (1,2,4 -triazol -1-yl) -butan -2- one, 1- (4-fluoro phenyl) -1- phenyl -1- (1,2,4 -triazol -1-yl) -butan -2- one, 1-(3-tri fluoro methyl phenyl) 35 35  
 35 1- phenyl -1- (1,2,4 -triazol -1-yl) -butan -2- one, 1, 1-diphenyl -3-methyl-1-(1,2,4 -triazol 1- yl) -butan -2- one, 1, 1-diphenyl -1- (1,2,4 -triazol -1-yl) -hexan -2-one, 1-(2-chloro phenyl) -1- phenyl -1- (1,2,4 -triazol -1-yl) -hexan -2-one, 1-(4-fluoro phenyl) -1- phenyl 40 40  
 40 -1- (1,2,4 -triazol -1-yl) -hexan -2-one, 1-(3-methyl phenyl) -1-phenyl -1- (1,2,4 -triazol -1- yl) -hexan -2- one, 1, 1-diphenyl-3-methyl -1- (1,2,4 -triazol -1-yl) -pentan -2- one, 1- (4-chloro-phenyl) -1- phenyl -3-methyl -1- (1,2,4 -triazol -1-yl) -pentan -2-one, 1- (4-fluoro phenyl) -1- phenyl -3- methyl -1- (1,2,4 -triazol -1-yl) -pentan -2-one, 1- (2-methyl phenyl) -1- phenyl -3- methyl -1- (1,2,4 -triazol -1-yl) -pentan -2-one, 1- (2,4-dimethyl phenyl) -1- phenyl-3-methyl -1- (1,2,4 -triazol -1-yl) -pentan -2-one, 1, 1- 45 45  
 45 diphenyl-3, 3-dimethyl -1- (1,2,4 -triazol -1-yl) -butan -2-one, 1, 1-diphenyl- 3, 3-dimethyl 1- (1,2,4 -triazol -4- yl) -butan -2- one, 1-(2-chloro phenyl) -1- phenyl-3, 3-dimethyl -1- (1,2,4 -triazol -1-yl) -butan -2-pne, 1-(2-chloro phenyl) -1- phenyl -3, 3-dimethyl -1- (1,2,4 -triazol -4- yl) -butan -2-one, 1-(4-chloro-phenyl) -1- phenyl -3, 3-dimethyl -1- (1,2,4 -triazol -1-yl) -butan -2-one, 1-(4-chloro phenyl) -1- phenyl -3, 3-dimethyl -1- (1,2,4 -triazol -4- yl) -butan -2-one, 1-(4-fluoro phenyl) -1- phenyl -3, 3-dimethyl -1- (1,2,4 -triazol -1-yl) -butan -2-one, 1- (3-trifluoro- methyl phenyl) -1- phenyl -3, 3-dimethyl -1- (1,2,4 -triazol -1-yl) -butan -2-one, 1-(2-methylphenyl) -1- phenyl -3, 3-dimethyl -1- (1,2,4 -triazol -1-yl) -butan -2-one, 1-(3-methyl phenyl) -1- phenyl -3, 3-dimethyl -1- (1,2,4 -triazol -1-yl) -butan -2-one, 1-(4-methoxy phenyl) -1-phenyl-3, 3-dimethyl -1- (1,2, 4-triazaol -1- yl) -butan -2-one, 1-(4-ethoxy phenyl) -1- phenyl-3, 3-dimethyl-1- (1,2,4 -triazol -1- yl) -butan -2-one, 1-(4-methyl thio phenyl) -1- phenyl-3, 3-dimethyl -1- (1,2,4 -triazol -1- yl) -butan -2-one, 1-(4-chloro -3-methyl phenyl) -1- phenyl -3, 3-dimethyl -1- (1,2,4 -triazol -1-yl) -butan -2-one, 1-(3, 4-dimethyl phenyl) -1- 50 50  
 50 phenyl -3, 3-dimethyl -1- (1,2, 4-triazol -1-yl) -butan -2-one, 1-(2,4- dimethyl phenyl) -1- 1-phenyl -3, 3-dimethyl -1- (1,2,4 -triazol -1-yl) -butan -2-one, 1-(4-phenoxy phenyl) -1- phenyl -3, 3-dimethyl -1- (1,2,4 -triazol -1-yl) -butan -2-one, 1-(4-4' -chloro phenoxy- phenyl) -1- phenyl -3, 3-dimethyl -1- (1,2,4 -triazol -1-yl) -butan -2-one, 1-(4-biphenyl) -1- 1- phenyl -3, 3-dimethyl -1- (1,2,4 -triazol -1-yl) -butan -2-one, 1-(4-biphenyl) -1- 60 60  
 60 phenyl -3, 3-dimethyl -1- (1,2, 4-triazol -4- yl) -butan -2-one, 1-(4-4' -chloro- biphenylyl) 65 65  
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1- phenyl -3, 3-dimethyl -1- (1,2,4 -triazol -1- yl) -butan-2-one, 1-(2,4- dichloro phenyl)  
 1- phenyl-3, 3-dimethyl -1- (1,2, 4-triazol-1-yl) -butan -2- one, 1-(nitro phenyl) -1- phenyl  
 3, 3-dimethyl -1- (1,2,4- triazol -1-yl) -butan -2-one, 1-(4-cyano- phenyl-3, 3-dimethyl -1-  
 (1,2,4 -triazol -1- yl) -butan-2-one, 1-bis- (4-chloro phenyl) -3, 3-dimethyl -1- (1,2,4  
 triazol -1- yl) - butan-2-one, 1-bis-(4-chloro phenyl) -3, 3-dimethyl -1- (1,2, 4-  
 triazol-4-yl)-butan-2- one, 1-bis- (4-methyl phenyl) -3, 3-dimethyl -1- (1,2, 4-triazol -1-  
 yl) -butan -2-one, 1-(4-chloro-phenyl) -1- (4-fluoro phenyl) -3, 3-dimethyl -1- (1,2,4  
 triazol -1- yl) -butan -2- one, 1-(4-fluoro phenyl) -1- (4-phenoxy phenyl) -3, 3- dimethyl  
 1- (1,2, 4-triazol -1-yl) -butan -2- one, 1- (4-bis phenyl)- 1- (4-phenoxy phenyl) -3,  
 10 3-dimethyl -1- (1,2,4- triazol -1-yl)- butan-2-one, benzoyl-diphenyl- 1,2, 4-triazol -1-  
 yl-methane, benzoyl-diphenyl -1,2,4 -triazol-4- yl -methane, benzoyl-(4-chloro phenyl)  
 phenyl -1, 2, 4-triazol-1-yl-methane, benzoyl-(4-chlorophenyl) -phenyl -1,2,4 -triazol-4-yl  
 methane, benzoyl- (4- fluoro phenyl) -phenyl-1,2,4- triazol -1- yl -methane, benzoyl- (3- tri  
 fluoro methyl phenyl) -phenyl-1, 2, 4-triazol -1- yl -methane, benzoyl- (3-methyl phenyl)  
 15 phenyl -1, 2, 4-triazol -1- yl-methane, benzoyl-(4-methoxyphenyl) -phenyl-1, 2, 4-triazol  
 1- yl -methane, benzoyl- (3,4- di methyl phenyl) -phenyl-1,2,4-triazol-1-yl-methane,  
 benzoyl-(4-chloro -3- methyl phenyl) -phenyl -1,2,4-triazol -1- yl -methane, benzoyl-(4-  
 phenoxy phenyl) -phenyl-1,2,4-triazol -1- yl-methane, benzoyl-(4-4' -chloro phenoxy-  
 phenyl) -phenyl -1, 2,4-triazol -1- yl-methane, benzoyl-(4-bi phenyl) -phenyl-1, 2,  
 20 4-triazol -1- yl -methane, benzoyl- (4-4' -chloro biphenyl yl) -phenyl -1,2,4- triazol -1- yl -  
 methane, benzoyl- (2,4-dichloro phenyl) -phenyl -1,2,4 -triazol -1-yl - methane, benzoyl-bis-  
 (4-methyl phenyl) -1, 2, 4-triazol -1-yl -methane, benzoyl-(4-chloro phenyl) - (4-fluoro phenyl)  
 25 1,2,4- triazol-1- yl-methane, benzoyl- (4-fluoro phenyl) - (4-phenoxy- phenyl) -1,2,4-  
 triazol-1-yl -methane, benzoyl- (4-bis phenyl)- (4-phenoxy phenyl) -1,2,4 -triazol -1- yl-  
 methane, (4-chloro-benzoyl) -diphenyl-1, 2,4-triazol -1- yl -methane, (4-chloro- benzoyl)  
 diphenyl-1, 2, 4-triazol -4- yl -methane, (4-chloro benzoyl-(4- chloro phenyl) -phenyl-1, 2,  
 30 4-triazol -1- yl-methane, (4-chloro benzoyl) -(4-fluoro phenyl) -phenyl -1,2,4 -triazol -1-  
 yl-methane, (4-chloro benzoyl) - (3-trifluoro methyl phenyl) -phenyl-1, 2, 4-triazol -1- yl-  
 methane, (4-chloro benzoyl) - (3- methyl phenyl) -phenyl-1,2,4 -triazol -1- yl - methane, (4-chloro  
 benzoyl) - (4-phenoxy phenyl) -phenyl -1,2,4 -triazol -1- yl - methame, (4-fluoro benzoyl)  
 diphenyl -1,2,4 -triazol -1- yl- methane, (3-methyl benzoyl) -diphenyl-1, 2, 4-triazol-1-yl-  
 35 methane, (4-fluoro benzoyl) - (4-chloro phenyl) -phenyl-1,2,4-triazol -1- yl -methane and  
 (3-methyl benzoyl) - (4-chloro phenyl) - phenyl-1, 2,4- triazol-1-yl methane.  
 Some of the compounds which can be used according to the invention are known (see  
 German Offenlegungsschrift (German Published Specification) 2,037,610). However, their  
 use as fungicides and nematicides is new.

The majority of the compounds which can be used according to the invention are new;  
 40 however, they can be prepared in a simple manner, in accordance with known processes.  
 For example, they are obtained when the corresponding known diphenyl- halogeno-  
 methanes are reacted with 1,2, 4-triazole in the presence of an acid-binding agent, for  
 example an excess of the triazole, and, if appropriate, in the presence of a polar organic  
 45 solvent, for example, acetonitrile, preferably in the temperature range of between 20° and  
 100°C, and the product is isolated in accordance with customary methods (further details  
 relating thereto are to be found in the preparative Examples given later in this text).

Suitable salts of the compounds of the formula (I) are salts with physiologically tolerated  
 acids, especially the hydrogen halide acids, for example hydrobromic acid and, especially,  
 hydrochloric acid, phosphoric acid, nitric acid, monofunctional and bifunctional carboxylic  
 50 acids and hydroxycarboxylic acids, such as, for example, acetic acid, maleic acid, succinic  
 acid, fumaric acid, citric acid, salicylic acid, sorbic acid, tartaric acid and lactic acid, and  
 1,5-naphthalen edisulphonic acid.

The salts of the compounds of the formula (I) can be obtained in a simple manner in  
 accordance with customary methods of forming salts, for example by dissolving the base in  
 ether, for example diethyl ether, and adding the acid, for example nitric acid, and can, using  
 known methods, be isolated, for example by filtering off, and be purified if appropriate.

The active compounds according to the invention exhibit a powerful fungitoxic action and  
 a bacterio toxic action. They do not damage crop plants in the concentrations required for  
 combating fungi and bacteria. For these reasons they are suitable for use as plant protection  
 60 agents for combating fungi and bacteria. Fungitoxic agents are employed in plant protection  
 for combating *Plasmodiophoro-myceses*, *Oomycetes*, *Chytridiomycetes*, *Zygomycetes*,  
*Ascomycetes*, *Basidiomycetes* and *Deuteromycetes*.

The active compounds according to the invention have a broad spectrum of action and  
 can be used against parasitic fungi which attack above-ground parts of plants or which  
 attack the plants through the soil, and also against seed-borne pathogens.

They display a particularly good activity against parasitic fungi on above-ground parts of plants, such as powdery mildew fungi, for example against species of *Erysiphe* and species of *Podosphaera*, and also against species of *Venturia*. In addition, they exhibit a high activity against cereal diseases, such as against cereal mildew and cereal rust. An aspect to be pointed out particularly is that the active compounds according to the invention not only display a protective action, but are also curatively active, that is to say when used after infection has occurred. Furthermore, the systemic action of the compounds should be pointed out. Thus, it proves possible to protect plants against fungal attack by supplying the active compound to the above-ground parts of the plant through the soil and the root or through the seeds.

As plant protection agents, the compounds according to the invention can be used for the treatment of soil, the treatment of seed and the treatment of above-ground parts of plants. Because of their low odour and their good toleration by human skin, they are not unpleasant to handle.

When used as seed dressings, the compounds according to the invention are active against seed-borne plant diseases, namely by disinfecting the surface of the seed, for example when counteracting stripe disease of barley, and also systemically when counteracting fungal pathogens in the interior of the seed, as in the case of loose smuts of wheat and of barley. In addition, seed dressing achieves a systemic protective action against fungal infections of the shoot, for example against mildew.

The active compounds are also suitable for combating animal pests, especially nematodes, which occur in agriculture and in forestry. They are active against normally sensitive and resistant species and against all or some stages of development.

The plant-parasitic nematodes include *Pratylenchus* spp., *Radopholus similis*, *Ditylenchus dipsaci*, *Tylenchulus semipenetrans*, *Heterodera* spp., *Meloidogyne* spp., *Aphelenchooides* spp., *Longidorus* spp., *Xiphinema* spp. and *Trichodorus* spp..

The active compounds to be used according to the invention can be converted into the usual formulations, such as solutions, emulsions, suspensions, powders, pastes and granules. These may be produced in known manner, for example by mixing the active compounds with extenders, that is to say, liquid or solid or liquefied gaseous diluents or carriers, optionally with the use of surface-active agents, that is to say, emulsifying agents and/or foaming agents. In the case of the use of water as an extender, organic solvents can, for example, also be used as auxiliary solvents.

As liquid diluents or carriers, especially solvents, there are suitable in the main, aromatic hydrocarbons, such as xylene, toluene, benzene or alkyl-naphthalenes, chlorinated aromatic or chlorinated aliphatic hydrocarbons, such as chlorobenzenes, chloroethylenes or methylene chloride, aliphatic or alicyclic hydrocarbons, such as cyclohexane or paraffins, for example mineral oil fractions, alcohols, such as butanol or glycol as well as their ethers and esters, ketones, such as acetone, methyl ethyl ketone, methyl isobutyl ketone or cyclohexanone, or strongly polar solvents, such as dimethylformamide and dimethylsulphoxide, as well as water.

By liquefied gaseous diluents or carriers are meant liquids which would be gaseous at normal temperature and under normal pressure, for example aerosol propellants, such as dichlorodifluoromethane or trichloro fluoromethane.

As solid carriers there are preferably used ground natural minerals, such as kaolins, clays, talc, chalk, quartz, attapulgite, montmorillonite or diatomaceous earth, and ground synthetic minerals, such as highly dispersed silicic acid, alumina and silicates.

Preferred examples of emulsifying and foam-forming agents include nonionic and anionic emulsifiers, such as poly oxyethylene-fatty acid esters, poly-oxyethylene-fatty alcohol ethers, for example alkylaryl polyglycol ethers, alkyl sulphonates, alkyl sulphates and aryl sulphonates as well as albumin hydrolysis products; and preferred examples of dispersing agents include lignin sulphite waste liquors and methyl-cellulose.

The active compounds to be used according to the invention can be present in the formulations as a mixture with other active compounds, such as fungicides, insecticides, acaricides, nematicides, herbicides, bird repellants, growth factors, plant nutrients and agents for improving soil structure.

The formulations in general contain from 0.1 to 95 per cent by weight of active compound, preferably from 0.5 to 90 per cent.

The active compounds can be used as such, as their formulations or as the use forms prepared therefrom by further dilution, such as ready-to-use solutions, emulsions, suspensions, powders, pastes and granules. They may be used in the customary manner, for example by watering, spraying, atomising, dusting, scattering, dry dressing, moist dressing, wet dressing, slurry dressing or encrusting.

Especially when used as leaf fungicides, the active compound concentrations in the use forms can be varied within a fairly wide range. They are, in general, from 0.1 to 0.00001 per

cent by weight, preferably from 0.05 to 0.0001 per cent.

For the treatment of seed, amounts of active compound of 0.001 to 50 g per kilogram of seed, preferably 0.01 to 10 g, are in general employed.

When used as nematicides, the active compound content can be varied within wide ranges. The active compound concentration of the use forms can be from 0.0000001 to 100% by weight of active compound, preferably from 0.01 to 10% by weight.

When relatively high concentrations are used, the compounds usable according to the invention show plant growth-regulating properties.

The present invention further provides crops protected from damage by nematodes or fungi by being grown in areas in which immediately prior to and/or during the time of the growing a compound of the formula (I), or a physiologically tolerated salt thereof, was applied alone or in admixture with a diluent or carrier.

It will be seen that the usual methods of providing a harvested crop may be improved by the present invention.

15 The fungicidal and nematicidal activity of the compounds to be used according to this invention is illustrated by the following biotest Examples.

*Example A*

*Erysiphe* test (cucumbers)/protective

Solvent: 4.7 parts by weight of acetone

20 Emulsifier: 0.3 part by weight of alkylaryl polyglycol ether

Water: 95 parts by weight.

The amount of the active compound required for the desired concentration of active compound in the spray liquid was mixed with the stated amount of the solvent, and the concentrate was diluted with the stated amount of water containing the stated additions.

25 Young cucumber plants with about three foliage leaves were sprayed with the spray liquid until dripping wet. The cucumber plants remained in a greenhouse for 24 hours to dry. They were then, for the purpose of inoculation, dusted with conidia of the fungus *Erysiphe cichoriacearum*. The plants were subsequently placed in a greenhouse at 23-24°C and at a relative atmospheric humidity of about 75%.

30 After 12 days, the infection of the cucumber plants was determined. The assessment data were converted to per cent infection. The assessment data were converted to per cent infection. 0% meant no infection; 100% meant that the plants were completely infected.

The active compounds, the concentrations of the active compounds and the results can be seen from the following table:

5

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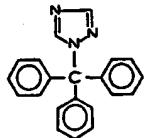
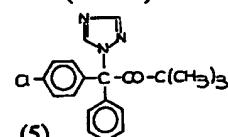
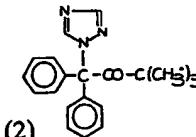
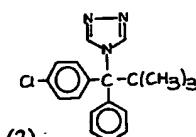
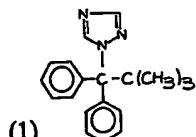
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20

25

30

Table A

	<i>Erysiphe</i> test (cucumbers)/protective	Infection in % at an active compound concentration of	
5	Active compound	0.00078 0.0005 0.00025	5
10		63	10
15	(known)	-	15
20		0	20
25		0	25
30			30
35		22	35
40		17	40
45			45

*Example B*

Shoot treatment rest/cereal mildew  
(leaf-destructive mycosis)

To produce a suitable preparation of active compound, 0.25 part by weight of active compound was taken up in 25 parts by weight of di-methyl-formamide and 0.06 part by weight of alkylaryl polyglycol ether; 975 parts by weight of water were then added. The concentrate was diluted with water to the desired final concentration of the spray liquor.

To test for protective activity, single-leaved young barley plants of the Amsel variety were sprayed with the preparation of active compound until dew-moist. After drying, the barley plants were dusted with spores of *Erysiphe graminis var. hordei*.

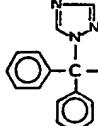
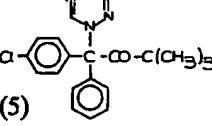
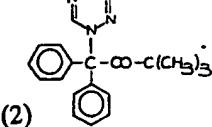
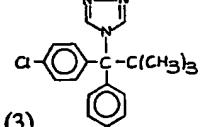
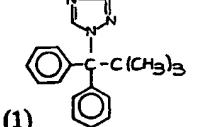
To test for curative activity the corresponding procedure was followed in converse sequence. The treatment of the single-leaved young barley plants with the pre-partition of active compound was carried out 48 hours after inoculation, when the infection was already manifest.

After 6 days' dwell time of the plants at a temperature of 21-22°C and 80-90% atmospheric humidity the occurrence of mildew pustules on the plants was evaluated. The degree of infection was expressed as a percentage of the infection of the untreated control plants. 0% denoted no infection and 100% denoted the same degree of infection as in the case of the untreated control. The active compound was the more active, the lower was the degree of mildew infection.

The active compounds, active compound concentrations in the spray liquor and degrees of infection can be seen from the table which follows.

Table B

## Shoot treatment test/cereal mildew/protective/curative

	Active compounds	Active compound concentration in the spray liquor in % by weight	Infection in % of the untreated control	
Untreated	—	—	protective / curative 100.0 100.0	
	0.025	100.0 100.0		
(known)				
	0.025	0.0 —		
(5)				
	0.025	0.0 0.0		
(2)				
	0.025	18.8 0.0		
(3)				
	0.025	0.0 0.0		
(1)				

## Example C

Powdery mildew of barley test (*Erysiphe graminis* var. *hordei*)/systemic (fungal disease of cereal shoots)

The active compounds were used a pulverulent seed treatment agents. They were prepared by extending the particular active compound with a mixture of equal parts by weight of talc and kieselguhr to give a finely pulverulent mixture of the desired concentration of active compound.

For the treatment of seed, barley seed was shaken with the extended active compound in a closed glass bottle. The seed was sown at the rate of 3 x 12 grains in flowerpots, 2cm deep, in a mixture of one part by volume of Fruhstorfer standard soil and one part by volume of quartz sand. The germination and emergence took place under favourable conditions in a greenhouse. 7 days after sowing, when the barley plants had developed their first leaf, they were dusted with fresh spores of *Erysiphe graminis* var. *hordei* and grown further at 21-22°C and 80-90% relative atmospheric humidity and 16 hours' exposure to light. The typical mildew pustules formed on the leaves over the course of 6 days.

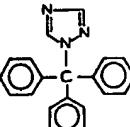
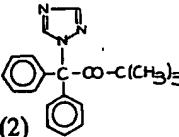
The degree of infection was expressed as a percentage of the infection of the untreated

control plants. Thus, 0% denoted no infection and 100% denoted the same degree of infection as in the case of the untreated control. The active compound was the more active, the lower was the degree of mildew infection.

The active compounds and concentrations of active compound in the seed treatment agent, as well as the amount used of the latter, and the percentage infection with mildew can be seen from the table which follows.

Table C

10 Powdery mildew of barley test (*Erysiphe graminis* var. *hordie*)/systemic 10

15	Active compounds	Active compound concentration in the dressing in % by weight	Amount of dressing used in g/kg of seed	Infection in % of the untreated control	15
	Without dressing	—	—	100.0	
20		25	10	88.8	20
25	(known)				25
30		25	10	0.0	30
35					35

*Example D*

Shoot treatment test/cereal rust/protective (leaf-destructive mycosis)

To produce a suitable preparation of active compound, 0.25 part by weight of active compound was taken up in 25 parts by weight of di-methyl-formamide and 0.06 part by weight of alkylaryl polyglycol ether; 975 parts by weight of water were then added. The concentrate was diluted with water to the desired final concentration of the spray liquor.

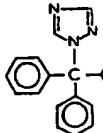
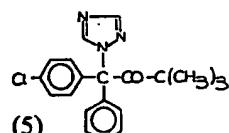
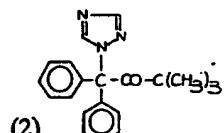
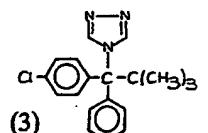
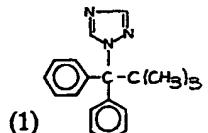
To test the protective activity, one-leaved young wheat plants of the Michigan Amber variety were inoculated with a uredospore suspension of *Puccinia recondita* in 0.1% strength aqueous agar. After the spore suspension had dried on, the wheat plants were sprayed with the preparation of active compound until dew-moist and were placed, for incubation, in a greenhouse for 24 hours at about 20°C and 100% relative atmospheric humidity.

After 10 days' dwell time of the plants at a temperature of 20°C and 80-90% atmospheric humidity, the occurrence of rust pustules on the plant was evaluated. The degree of infection was expressed as a percentage of the infection of the untreated control plants. 0% denoted no infection and 100% denoted the same degree of infection as in the case of the untreated control. The active compound was the more active, the lower was the degree of rust infection.

The active compounds, active compound concentrations in the spray liquor and degrees of infection can be seen from the table which follows.

**Table D**

Shoot treatment test/cereal rust/protective

5	Active compounds	Active compound concentration in the spray liquor in % by weight	Infection in % of the untreated control	5
Untreated				
10		-	100.0	10
15		0.025	100.0	15
20	(5)		0.0	20
25		0.025	13.8	25
30		0.025	17.5	30
35				35
40		0.025	0.0	40
45	<b>Example E</b> <i>Podosphaera</i> test (powdery mildew of apples)/protective			45
	Solvent: 4.7 parts by weight of acetone			
	Emulsifier: 0.3 parts by weight of alkylaryl polyglycol ether			
	Water: 95 parts by weight			
50	The amount of active compound required for the desired concentration of the active compound in the spray liquid was mixed with the stated amount of solvent, and the concentrate was diluted with the stated amount of water which contained the stated additions.			50
	Young apple seedlings in the 4 - 6 leaved stage were sprayed with the spray liquid until dripping wet. The plants remained in a greenhouse for 24 hours at 20°C and at a relative atmospheric humidity of 70%. They were then inoculated by dusting with conidia of the apple powdery mildew causative organism ( <i>Podosphaera leucotricha</i> ) and placed in a greenhouse at a temperature of 21 - 23°C and at a relative atmospheric humidity of about 70%.			
55	10 days after the inoculation, the infection of the seedlings was determined. The ratings obtained were converted to percentage infection. 0% meant no infection; 100% meant that the plants were completely infected.			55
60				60

The active compounds, the concentrations of the active compounds and the results can be seen from the following table.

Table E

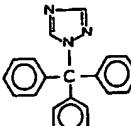
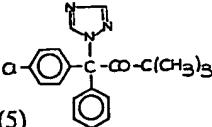
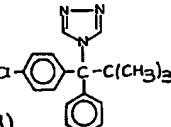
		Podosphaera test (powdery mildew of apples)/ protective				
10	Active compound	Infection in % at an active compound concentration of			10	
		0.00039	0.00031	0.00025		
15					15	
20					20	
25	(5)				25	
30					30	
35	(3)				35	
40	<i>Example F</i> Critical concentration test Test nematode: <i>Meloidogyne incognita</i> Solvent: 3 parts by weight of acetone Emulsifier: 1 part by weight of alkylaryl polyglycol ether	To produce a suitable preparation of active compound, 1 part by weight of active compound was mixed with the stated amount of solvent, the stated amount of emulsifier was added and the concentrate was diluted with water to the desired concentration.			40	
45	The preparation of active compound was intimately mixed with soil which was heavily infested with the test nematodes. The concentration of the active compound in the preparation was of practically no importance; only the amount of active compound per unit volume of soil, which is given hereinafter in ppm (= mg/l), was decisive. The soil was filled into pots, lettuce was sown in and the pots were kept at a greenhouse temperature of 27°C.				45	
50	After 4 weeks, the lettuce roots were examined for infestation with nematodes (root galls), and the degree of effectiveness of the active compound was determined as a percentage. The degree of effectiveness was 100% when infestation was completely avoided; it was 0% when the infestation was exactly the same as in the case of the control plants in untreated soil which had been infested in the same manner.				50	
55	The active compound, the amounts applied and the results can be seen from the following table.				55	

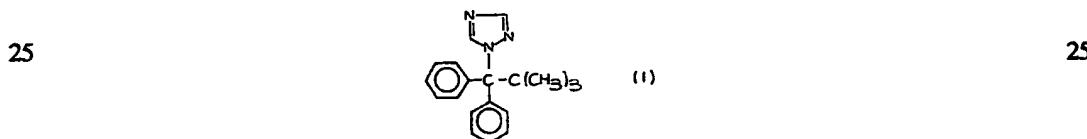
Table F

## Nematicides

5	(Meloidogyne incognita)	5
10	Active compound	Degree of destruction in % at an active compound concentration in ppm 20 ppm

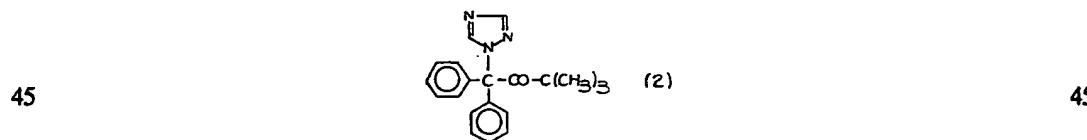


20 The preparation of the active compounds to be used according to this invention is illustrated by the following Examples.

*Example 1*

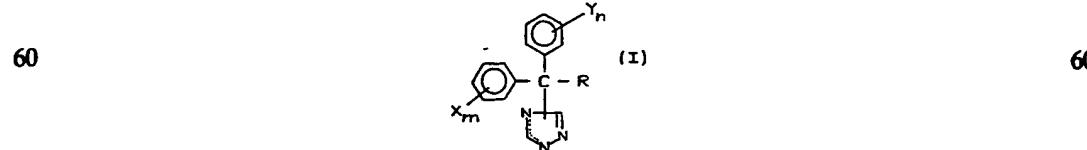
30 26.9 g (0.1 mol) of 1-chloro -2, 2-dimethyl-1, 1-diphenyl- propane in 50 ml of acetonitrile were added dropwise, whilst stirring, to a boiling solution of 7 g (0.1 mol) of 1,2,4-triazole and 16 g of potassium carbonate in 200 ml of aceto-nitrile. The mixture was then heated for 48 hours under reflux. It was allowed to cool and was then filtered. The filtrate was concentrated by distilling off the solvent *in vacuo*. The residue was taken up in ethyl acetate, and the solution was repeatedly washed with water, dried over sodium sulphate and again concentrated by distilling off the solvent. The residue crystallised after addition of ligroin. After recrystallisation from ligroin/ethyl acetate (6:1), 12 g (41% of theory) of 2,2-dimethyl-1, 1-diphenyl -1- (1,2,4-triazol -1- yl) -propane of melting point 137°C were obtained.

35 40 *Example 2*



50 51.3 g (0.15 mol) of 1-bromo-3, 3-dimethyl-1, 1-diphenyl-butan-2-one in 250 ml of aceto-nitrile were added dropwise, whilst stirring, to a boiling solution of 25 g (0.36 mol) of 1,2,4-triazole in 250 ml of aceto-nitrile and heating under reflux was then continued for 24 hours. The mixture was then concentrated by distilling off the solvent *in vacuo*, the residue was taken up in ethyl acetate and the solution was repeatedly washed with water, dried over sodium sulphate and concentrated by distilling off the solvent *in vacuo*. The residue crystallised after addition of ligroin. After recrystallisation from ligroin, 19 g (40% of theory) of 3,3-di methyl-1, 1-diphenyl -1- (1,2,4-triazol -1- yl) -butan-2-one of melting point 99°C were obtained.

55 The following examples of the general formula



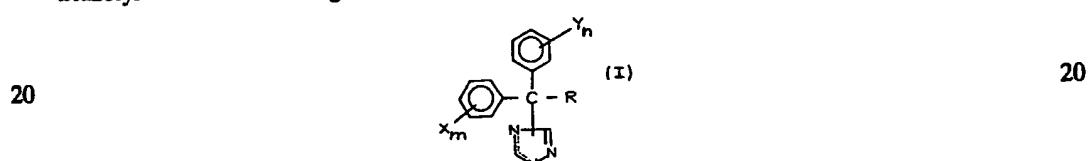
65 were obtained analogously to the above examples.

65

Example No.	X <sub>m</sub>	Y <sub>n</sub>	R	Position where the 1,2,4-triazolyl radical is linked	Melting point (°C)	
5	3	4-Cl	-	C(CH <sub>3</sub> ) <sub>3</sub>	(4)	155
	4	-	-	-CO-CH <sub>3</sub>	(1)	168
10	5	4-Cl	-	-CO-C(CH <sub>3</sub> ) <sub>3</sub>	(1)	126

## WHAT WE CLAIM IS:-

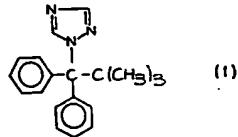
15 1. A fungicidal or nematicidal composition containing as active ingredient a diphenyl-triazolyl-methane of the general formula



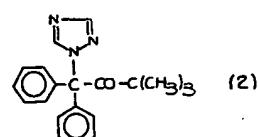
25 in which  
 25 R represents alkyl, alkyl-carbonyl or optionally substituted phenyl-carbonyl,  
 X and Y, which may be identical or different, each represent halogen, alkyl, halogenoalkyl, alkoxy, alkylthio, optionally substituted phenyl or phenoxy, nitro or cyano, and  
 m and n each represent 0 or an integer from 1 to 5, or a physiologically tolerated salt  
 thereof, in admixture with a solid or liquefied gaseous diluent or carrier or in admixture with  
 30 a liquid diluent or carrier containing a surface-active agent.

35 2. A composition according to claim 1, in which the active ingredient is such that R  
 represents alkyl with 1 to 4 carbon atoms, alkyl carbonyl with 1 to 4 carbon atoms in the  
 alkyl part or phenyl carbonyl which is optionally substituted by halogen or by alkyl with 1 or  
 2 carbon atoms, X and Y, which may be identical or different, each represent halogen,  
 straight-chain or branched alkyl with 1 to 4 carbon atoms, halogenoalkyl with 1 to 4 carbon  
 atoms and up to 5 halogen atoms, cyano, nitro, alkoxy with 1 or 2 carbon atoms, alkylthio  
 35 with 1 or 2 carbon atoms or phenyl or phenoxy, either of which is optionally substituted by  
 halogen or by alkyl with 1 or 2 carbon atoms, and m and n represent 0, 1, 2 or 3.

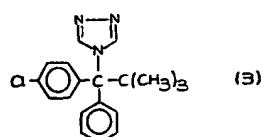
40 3. A composition according to claim 1, containing a compound of the formula



45 4. A composition according to claim 1, containing a compound of the formula

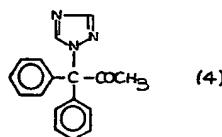


55 5. A composition according to claim 1, containing a compound of the formula



65 6. A composition according to claim 1, containing a compound of the formula

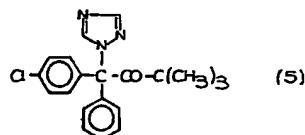
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7. A composition according to claim 1, containing a compound of the formula

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8. A composition according to claim 1 in which the active ingredient of the formula (I) is one that is hereinbefore specifically mentioned.

9. A composition according to claim 1 or 2, in which the active ingredient is in the form of a salt of an acid selected from hydrogen halides, phosphoric acid, nitric acid, monofunctional and bifunctional carboxylic and hydroxy-carboxylic acids and 1,5-naphth-thalene-disulphonic acid.

10. A composition according to any of claims 1 to 9, containing from 0.1. to 95% of the active compound by weight.

11. A method of combating nematodes or fungi which comprises applying to the nematodes or fungi, or to a habitat thereof, a compound or salt as specified in any of claims 1 to 9 alone or in the form of a composition containing as active ingredient a compound or salt as specified in any of claims 1 to 9, in admixture with a diluent or carrier.

12. A method according to claim 11 in which a composition is used, as a fungicide, containing from 0.00001 to 0.1% of the active compound, by weight.

13. A method according to claim 12 in which a composition is used containing from 0.0001 to 0.05% of the active compound, by weight.

14. A method according to claim 11, 12 or 13, in which the active compound is applied to seed in an amount of 0.001 to 50 g per kg of seed.

15. A method according to claim 14, in which the active compound is applied to seed in an amount of 0.01 to 10 g per kg of seed.

16. A method according to claim 11 in which a composition is used, as a nematicide, containing from 0.0000001 to 100% of the active compound, by weight.

17. A method according to claim 16 in which a composition is used containing from 0.01 to 10% of the active compound, by weight.

18. Crops protected from damage by nematodes or fungi by being grown in areas in which immediately prior to and/or during the time of the growing a compound or salt as specified in any of claims 1 to 9 was applied alone or in admixture with a diluent or carrier.

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For the Applicants.

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